



GB03/04520



INVESTOR IN PEOPLE

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

REC'D 06 JAN 2004

WIPO

PCT

**PRIORITY
DOCUMENT**
SUBMITTED OR TRANSMITTED IN
COMPLIANCE WITH RULE 17.1(a) OR (b)

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

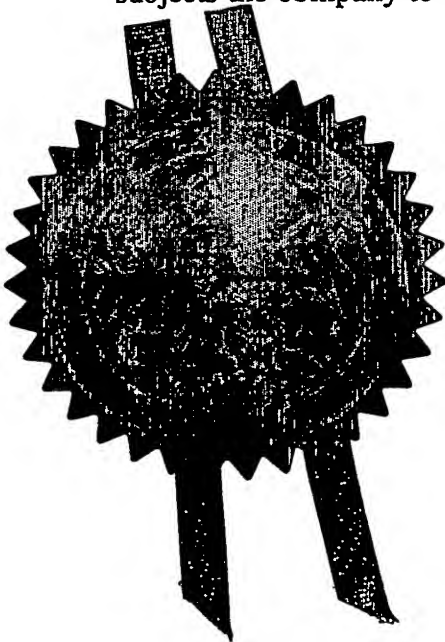
Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed

AmBrewster

Dated

5 December 2003



Patents Form 1/77

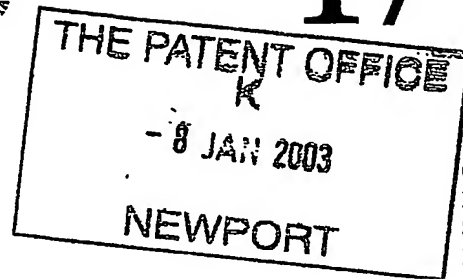
Patents Act 1977
(Rule 16)



1/77

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)



The Patent Office

Cardiff Road
Newport
South Wales
NP10 8QQ

1. Your reference

bmf.2545.uk.df.g

08JAN03 E775456-1 D10002
P01/7700 0.00-0300365.4

2. Patent application number

(The Patent Office will fill in this part)

0300365.4

3. Full name, address and postcode of the or of each applicant (underline all surnames)

Robert McFarlane

19 Speirs Road

LOCHWINNOCH

Patents ADP number (if you know it)

Renfrewshire

If the applicant is a corporate body, give the country/state of its incorporation

PA12 4BA

UNITED KINGDOM

8486714001

4. Title of the invention

Integrated respirator

5. Name of your agent (if you have one)

Kennedys Group

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

Floor 5, Queens House

29 St Vincent Place

Glasgow

G1 2DT

Patents ADP number (if you know it)

8058240002

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number
(if you know it)

Date of filing
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

- a) any applicant named in part 3 is not an inventor, or
- b) there is an inventor who is not named as an applicant, or
- c) any named applicant is a corporate body.

See note (d))

NO

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form.
Do not count copies of the same document

Continuation sheets of this form

Description 19

Claim(s)

Abstract

Drawing(s) 9

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

11. I/We request the grant of a patent on the basis of this application.

Signature

Date

KENNEDYS

07.01.03

12. Name and daytime telephone number of person to contact in the United Kingdom

David Fulton

0141 226 6826

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

- If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.*
- Write your answers in capital letters using black ink or you may type them.*
- If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.*
- If you have answered 'Yes' Patents Form 7/77 will need to be filed.*
- Once you have filled in the form you must remember to sign and date it.*
- For details of the fee and ways to pay please contact the Patent Office.*

Integrated Respirator

This invention relates to a respirator. In particular it relates to an integrated respirator that is suitable for use by aircrew so as to provide significant higher levels of comfort and user acceptability.

Aircrew can be exposed to nuclear, biological and chemical (NBC) hazards in the course of their flying duties. Therefore, in order to negate the effects of such NBC hazards any respiratory system as well as the crews eyes must be protected against aerosols and gases in the air. Additionally, the rest of the body of any crew member must be protected against direct contact with NBC agents in the form of liquid or solid particles.

Protection of respiratory systems, eyes and skin area above the neck of aircrew is normally achieved by wearing an integrated respirator. Typical integrated respirator known to those skilled in the art consists of, but are not exclusively limited to, a head cowl or hood, an oxygen mask, a breathing gas supply hose, a clear visor, a neck seal and a shoulder cover that forms a leak-proof assembly that fully encloses the head.

1 Such respirators are specifically designed to either fit
2 over or under the users flying helmet. Such designs have
3 a number of inherent problematic features. In particular
4 the over the helmet designs are bulky, and are easily
5 ruptured in wind blast and ejection forces exhibited
6 during emergency egress. Furthermore, it is difficult to
7 interface the over the helmet designs with other
8 equipment that requires to be mounted with the users
9 flying helmet.

10

11 For these reasons the under helmet configuration has been
12 adopted by most aircrew. There are two main types of
13 under helmet respirator known in the art. The first type
14 is worn under the helmet assembly and forms a close
15 fitting hood around the head with an integral visor
16 aperture and oxygen mask. This respirator type has
17 several deficiencies the principal being that most users
18 experience feelings of isolation or, semi-claustrophobia,
19 and heat stress attributed to the hood hugging the head
20 and being held firmly in place by the helmet.

21

22 A second limitation of this type of respirator is the
23 associated reduced sound attenuation performance of the
24 ear cup. This is due to the respirator cowl fitting
25 between the ear and the ear cup.

26

27 A further deficiency of these respirators is the fact
28 that the material used for the hood must stretch for
29 donning and doffing. Thereafter, the material must
30 conform to the profile of the user's head so as to
31 provide a suitable mounting surface for the helmet.
32 Bromo butyl rubber is an example of an elastic material
33 used in the manufacture of cowls for such respirators.

1 However, this material produces high levels of discomfort
2 when worn next to the skin.

3
4 Under helmet respirators with potentially lower levels of
5 discomfort are also available. However, the materials
6 used to construct such respirators do not stretch and as
7 such the cowl shape is required to be manufactured from
8 several shaped sections that are stitched and/or bonded
9 together. As a result these respirator designs are
10 particularly prone to leakage through the stitched and
11 bonded seams.

12
13 Another type of under helmet respirator known to those
14 skilled in the art employs comfort padding and
15 communication system ear cups on the inside surface of
16 the cowl. This arrangement allows air movement inside
17 the cowl reducing the thermal stress. In addition, as
18 the ear cups are in direct contact with the head this
19 results in improved levels of sound attenuation. The
20 major disadvantages of this type of respirator is the
21 difficulty experienced in getting the ear cups correctly
22 positioned inside the cowl and the requirement for an
23 increased number of leak proof feed through apertures
24 such as ear cup cableforms and comfort pad to suspension
25 system fastenings. This results in unacceptable donning
26 times and an increased potential for faults leading to
27 leakage.

28
29 It is an object of an aspect of the present invention to
30 provide an integrated respirator that provides a high
31 level of comfort and user acceptability by being designed
32 and constructed so as to reduce direct contact with a
33 user's head.

34

1 According to a first aspect of the present invention
2 there is provided an integrated respirator that provides
3 an airtight barrier for a user's head comprising a rigid
4 helmet and a flexible cowl having an airtight neck seal,
5 wherein the rigid helmet defines an access aperture
6 suitable for locating directly on a user's head and the
7 flexible cowl is sealably fixed to the rigid helmet so
8 providing a physical barrier for the access aperture
9 while forming an airtight seal with a user's neck.

10

11 Most preferably the rigid helmet and flexible cowl
12 comprises material that protects against nuclear,
13 chemical and biological hazards.

14

15 Preferably the flexible cowl is connected to the
16 periphery of the access aperture. Alternatively the
17 flexible cowl completely encloses the rigid helmet. In a
18 further alternative the flexible cowl connects to an
19 inner surface of the rigid helmet.

20

21 Most preferably the rigid helmet provides a tight fit
22 with the user's head.

23

24 Optionally the integrated respirator further comprises a
25 hood that is fixed to the rigid helmet so providing a
26 physical barrier for the flexible cowl thus improving the
27 fire proof, snag proof and windblast proof properties of
28 the integrated respirator.

29

30 Preferably the flexible cowl comprises a visor aperture,
31 an oxygen mask suspension system aperture, a visor mist
32 air supply and a pressure release valve.

33

1 Optionally the flexible cowl further comprises a
2 detachable front face connected to the flexible cowl by a
3 first airtight seal.

4
5 Preferably the first airtight seal comprises a beading
6 edge associated with the detachable front face, a channel
7 associated with the flexible cowl and suitable for
8 receiving the beading edge and a zip mechanism suitable
9 for opening and sealing the first airtight seal.

10
11 Optionally the flexible cowl comprises attachment point
12 access holes and compression seals.

13
14 Optionally the flexible cowl further comprises a head
15 cowl and a detachable lower section wherein the head cowl
16 and detachable lower section are connected by a second
17 airtight seal.

18
19 Preferably the second airtight seal comprises a beading
20 edge associated with the head cowl, a channel associated
21 with the detachable lower section and suitable for
22 receiving the beading edge and a zip mechanism suitable
23 for opening and sealing the second airtight seal.

24
25 Preferably the integrated respirator further comprises a
26 second helmet suitable for locating over the rigid
27 helmet, an oxygen mask suspension system and a first
28 visor.

29
30 Preferably the rigid helmet further comprises an energy
31 absorbing liner, attachment points suitable for
32 connection with the second helmet, ear phones, an
33 earphone exit point and points suitable for connecting to
34 the oxygen mask suspension system.

1 Optionally the rigid helmet comprises a retractable
2 earphone mount wherein the retractable earphone mount
3 comprises a bias means that acts to maintain the earphone
4 in a first position and a retracting means suitable for
5 overcoming the bias means such that the earphone is moved
6 to a second retracted position suitable for aiding the
7 donning and doffing of the integrated respirator.

8
9 Preferably the retracting means comprises a draw string
10 threaded through an aperture in the rigid helmet.

11
12 Most preferably the first visor locates within the first
13 visor aperture so providing a visor airtight seal with
14 the flexible cowl.

15
16 Optionally the visor airtight seal provides means for
17 adjustment of the position of the first visor relative to
18 the rigid helmet.

19
20 Preferably the means for adjustment allows the visor to
21 move to a displaced position suitable for aiding the
22 donning and doffing of the integrated respirator.

23
24 Most preferably the oxygen mask suspension system locates
25 within the oxygen mask suspension system aperture so
26 providing an airtight seal with the flexible cowl.

27
28 Preferably the oxygen mask suspension system comprises a
29 non-return inspiratory valve, and one or more non-return
30 expiratory valves, two or more mask mounting straps and
31 an air supply hose.

32

1 Most preferably the oxygen mask suspension system
2 comprises a coating that provides a barrier for nuclear,
3 biological and chemical hazards.

4
5 Most preferably on connecting the mask mounting straps to
6 the attachment points of the rigid helmet the oxygen mask
7 suspension system provides an air tight seal about the
8 user's nose and mouth.

9
10 Optionally the second helmet further comprises a second
11 visor.

12
13 Preferably the first and second visors comprise a high
14 optical quality material that provides a barrier for
15 nuclear, biological and chemical hazards.

16
17 According to a second aspect of the present invention
18 there is provided a method of fabricating an integrated
19 respirator in accordance with the first aspect of the
20 present invention comprising:

- 21 (1) Fabricating a flexible cowl;
- 22 (2) Forming an oxygen mask suspension system
23 aperture and a visor aperture in the flexible
24 cowl;
- 25 (3) Fabricating a visor and thereafter locating and
26 bonding said visor within the visor aperture;
- 27 (4) Constructing an oxygen mask suspension system
28 and thereafter locating and bonding said oxygen
29 mask suspension system within the oxygen mask
30 suspension system aperture; and
- 31 (5) Bonding the flexible cowl to an inner helmet.

32
33 Preferably location points on the helmet ensure that the
34 flexible cowl is correctly located on the inner helmet

1 and provide means for connecting the inner helmet to an
2 outer helmet.

3
4 Most preferably the flexible cowl is fabricated by:

- 5 1) Vacuum forming a flexible material and fixing the
6 vacuum formed material by seam welding;
- 7 2) Fabricating an airtight neck seal and attaching
8 said neck seal to the vacuum formed material;
- 9 3) Connecting a visor mist air supply to the vacuum
10 formed material; and
- 11 4) Connecting a pressure release valve to the vacuum
12 formed material.

13
14 Preferably the flexible material is resistant to nuclear,
15 biological and chemical hazards.

16
17 Preferably the visor is injection moulded from a material
18 of high optical coating. Thereafter the outer surface of
19 the visor is coated with a nuclear, biological and
20 chemical resistant coating. Optionally the inner surface
21 of the visor is coated with an anti fogging coating.

22
23 Embodiments of the invention will now be described, by
24 way of example only, with reference to the accompanying
25 drawings, in which:

26
27 Figure 1 present a schematic representation of an
28 integrated respirator in the absence of an
29 outer helmet in accordance with an aspect of
30 the present invention;

31 Figure 2 present a schematic representation of the outer
32 helmet suitable for use with the integrated
33 respirator of Figure 1;

1 Figure 3 presents detail of an inner helmet of the
2 integrated respirator of Figure 1;
3 Figure 4 presents detail of an oxygen mask of the
4 integrated respirator of Figure 1;
5 Figure 5 presents detail of a flexible cowl of the
6 integrated respirator of Figure 1;
7 Figure 6 presents detail of a connection means for a
8 visor and the flexible cowl of Figure 5:
9 (a) when the visor is positioned over a user's
10 eyes; and
11 (b) when the visor is in a displaced position
12 suitable for donning and doffing the
13 integrated respirator;
14 Figure 7 presents detail of an alternative embodiment
15 connection means for the visor and the flexible
16 cowl of Figure 5;
17
18 Figure 8 illustrates the formation of the integrated
19 respirator by employing a vacuum forming
20 method;
21 Figure 9 presents an alternative embodiment of the
22 integrated respirator in accordance with
23 aspects of the present invention;
24 Figure 10 presents detail of an attachment means of the
25 integrated respirator of Figure 9;
26 Figure 11 presents a further alternative embodiment of
27 the integrated respirator in accordance with
28 aspects of the present invention; and
29 Figure 12 presents a yet further alternative embodiment
30 of the integrated respirator in accordance with
31 aspects of the present invention;
32 Figure 13 presents detail of a connection means for an
33 earphone and a flexible cowl of the integrated
34 respirators of Figure 11 and 12:

- (a) when the earphone is positioned over a user's ear; and
- (b) when the earphone is in a displaced position suitable for donning and doffing the integrated respirator;

Figure 1 presents an integrated respirator 1 in accordance with an aspect of the present invention. The integrated respirator 1 can be seen to comprise an inner helmet 2, an oxygen mask suspension system 3, a visor demist air supply 4, a flexible cowl 5 on which is mounted a first visor 6 and a non-return exhaust valve 7.

The first visor 6 shown in Figure 1 is manufactured from a high optical quality material and is bonded or welded to the flexible cowl 5. NBC hazards when deposited on the visor would attack the surface of conventional polycarbonate visors therefore, to protect the visor a NBC resistant coating is applied to the outer surface. The inner surface is also be coated with an anti fogging coating.

The visor demist air supply 4 also helps to prevent the misting of the visor by supplying a flow of air that is directed over the visor. The air, in normal mode, is exhausted from the flexible cowl 5 through the non-return exhaust valve 7.

Figure 2 presents an outer helmet 8 suitable for use with the integrated respirator 1. The outer helmet 8 comprises an outer shell 9 on which are located outer to inner helmet attachment points 10 and a detachable second visor 11.

1 Details of the inner helmet 2, the oxygen mask 3 and the
2 flexible cowl 5 are presented in Figures 3, 4 and 5
3 respectively. The inner helmet 2 comprises an NBC
4 resistant shell 12 with attachment points 13 for both the
5 outer helmet 8 and oxygen mask suspension system 3. The
6 inner helmet 2 is lined with impact absorbing liners 14
7 and earphones 15 and earphone cabling 16 are attached to
8 the inner surface.

9
10 The oxygen mask suspension system 3, shown in Figure 4
11 comprises a face seal 17 that acts to isolate the mask
12 oro-nasal breathing cavity from the flexible cowl 5 and
13 the first visor 6. Therefore, the face seal 17 helps
14 prevent misting of the first visor 6 by exhaled gases
15 from the user. Breathing gas is supplied to the user by
16 inhalation through a non-return inspiratory valve 18. On
17 being exhaled the gas exits the oxygen mask suspension
18 system 3 through a first non-return expiratory valve 19.
19 To prevent any reverse gas flow into the oxygen mask
20 suspension system 3 a second non-return valve 20 is
21 fitted in series with the first 19 so as to create an
22 isolating chamber 21.

23

24 An examination of Figure 4 shows that the oxygen mask
25 suspension system 3 further comprises two mask mounting
26 means 22, two mask retention assemblies 23 and a gas
27 supply hose 24. The combination of the mask mounting
28 means 22 and the mask retention assemblies 23 allow the
29 oxygen mask suspension system 3 to be directly connected
30 to the inner helmet therefore helping to maintain the air
31 tight seal between the face seal 17 and the flexible cowl
32 5.

33

1 The gas supply hose 24 comprises a flexible pipe that is
2 resistant to penetration by NBC contaminants. The hose
3 24 is connected at one end to the face seal 17 while the
4 other end is coupled to a supply of filtered air or
5 oxygen from an aircraft oxygen generator. The gas supply
6 hose 24 can also be coupled to a portable air supply for
7 transit to and from an aircraft.

8
9 The flexible cowl 5 shown in Figure 5 specifically covers
10 the portion of the head and neck of the user that is not
11 protected by the inner helmet 2 and any NBC clothing worn
12 by the user. A neck seal 25 provides the required
13 airtight seal between the flexible cowl and the user's
14 neck.

15
16 The oxygen mask suspension system 3 and the first visor 6
17 are attached to the flexible cowl 5 and sealed to form a
18 leak proof assembly. The non-return exhaust valve 7 acts
19 as a pressure relief valve to prevent over pressurisation
20 within the flexible cowl 5. The non-return exhaust valve
21 7 itself comprises two valves in series so as to prevent
22 any reverse flow of gases back into the flexible cowl 5.

23
24 When the integrated respirator 1 is correctly mounted on
25 the head, the oxygen mask suspension system 3 determines
26 the viewing aperture located between the oxygen mask 3
27 and the brow of the inner helmet 2. This viewing
28 aperture, and in particular the vertical distance, varies
29 from subject to subject. Therefore, to accommodate these
30 variations, with a minimum number of visor sizes, an
31 adjustable means 26 of fitting the first visor 6 to the
32 flexible cowl has been developed.

33

Figure 6(a) presents detail of the adjustable means 26 that is characterised in that it is larger in the vertical dimension, than the viewing aperture provided. A space under the brow of the inner helmet 2 is produced by foreshortening the energy absorbing liner 14. Therefore, when the first visor 6 is too large for the aperture the top of the first visor 6 is inserted into the space underneath the inner helmet 2 as shown. The upper area of the flexible cowl 5 has sufficient material to allow the first visor 6 to move into the space underneath the inner helmet 2. Similarly sufficient material is provided between the oxygen mask suspension system and the first visor 6 so as to set the distance between the eyes and the inner surface of the first visor 6. To hold the first visor 6 in the optimum position it can be attached directly to the inner helmet 2 by, for example, draw strings.

A further advantage of incorporating the visor adjustment means 26 within the integrated respirator 1 can be seen in Figure 6(b). When donning the integrated respirator 1 the excess material of the flexible cowl 5 around the first visor 6 and the oxygen mask suspension system 3 permits both of these elements to be displaced to a position suitable for aiding the donning and doffing of the integrated respirator 1.

An alternative adjustment means 27 that also provides a method of accommodating the variations in vertical height between the oxygen mask suspension system 3 and the inner helmet 2 is shown in Figure 7. In this case, the flexible cowl material that attaches the first visor 6 to the brow and side apertures of the inner helmet 2, allows for fore and aft adjustment. As such the lower portion

1 of the first visor 6 can sit over the oxygen mask
2 suspension system 3.

3
4 To assemble the integrated respirator 1, the flexible
5 cowl 5, with integral visor 6 and oxygen mask suspension
6 system 3, is pulled over the inner helmet 2. Location
7 points can be provided on the inner helmet 2 to ensure
8 that the flexible cowl 5 is correctly positioned. This
9 ensures the respirator components, such as the visor 6
10 and oxygen mask suspension system 3, are correctly
11 positioned. The overlap area between the inner helmet 2
12 and the flexible cowl 5 is bonded to ensure a leak tight
13 seal preventing any ingress of agents when there is a
14 negative pressure inside the visor 6 or inner helmet 2.

15
16 The flexible cowl 5 and inner helmet 2 assembly when
17 donned, is not in contact with the user's head but
18 contacts the user at the neck seal 25 area. This
19 configuration prevents unacceptable levels of discomfort
20 when wearing the NBC head protection.

21
22 By employing the aforementioned adjustment means, 26 or
23 27, provides that one particular flexible cowl 5 can be
24 used in conjunction with a number of inner helmets 2 of
25 varying dimensions. This factor increases the
26 compatibility of employing the same design of integrated
27 respirator 1 with different users while allowing minor
28 adjustments to increase user comfort.

29
30 Additional protection for the flexible cowl from
31 penetration by debris during and after ejection from an
32 aircraft may also be achieved by incorporating a hood
33 (not shown) that is attached to the lower edge of the
34 inner helmet so as to envelope the flexible cowl. Such a

1 hood provides further fire proof, snag proof and
2 windblast proof properties to the integrated respirator.

3

4 One method of fabricating the integrated respirator 1 is
5 to vacuum form the developed shape of the flexible cowl 5
6 from a sheet of NBC resistant flexible material as shown
7 in Figure 8. The flexible cowl 5 is formed by seam
8 welding to produce a leak-tight joint 28. Thereafter,
9 the oxygen mask suspension system 29 and visor apertures
10 30 are cut out of the flexible cowl.

11

12 The visor 6 is then injection moulded, for example from
13 polycarbonate to a high optical quality and coated with a
14 NBC resistant coating on the outside surface and with an
15 anti fogging coating, if required, on the inside.
16 Bonding areas of the visor 6 and the flexible cowl 5 are
17 then prepared and the visor coating can, if required, be
18 stripped off to provide a suitable bonding surface. The
19 visor 6 can then be bonded to the flexible cowl 5 using a
20 suitable adhesive.

21

22 In a similar manner the outer surface of the oxygen mask
23 suspension assembly 3 is bonded into the appropriate
24 aperture 29 in the flexible cowl 5 so as to produce the
25 required leak tight seal.

26

27 The neck seal 25 is also formed from a flexible NBC
28 resistant material and bonded to the flexible cowl 5 to
29 provide the required leak-tight seal at the neck area of
30 the user.

31

32 An alternative embodiment of the integrated respirator 1
33 is shown in Figure 9. In this embodiment the flexible
34 cowl 5 comprises a detachable front section 31. Located

1 on the front section 31 are the first visor 6 and the
2 oxygen mask suspension system 3. Therefore, the
3 detachable front section 31 allows for the removal of the
4 first visor 6 and oxygen mask suspension assembly 3 if
5 access is required in, for example, an emergency where
6 the inspiratory 18 or expiratory valves 19 and 20 have
7 jammed or the demist air supply 4 has failed.

8
9 The detachable front section 31 is attached and detached
10 by means of an airtight seal 32, detail of which are
11 provided in Figure 10. The airtight seal 32 comprises a
12 beaded edge 33 formed on the front section 31 and a
13 channel 34 that matches the shape of the beading 33,
14 formed on the flexible cowl 5. A zip 35 operating in zip
15 guides 36 formed in the flexible cowl 5 and the front
16 section 31 pull the front section beaded edge 33 into the
17 channel 34 in the flexible cowl 5 thus forming a leak
18 proof seal, as required.

19
20 A further alternative embodiment of the integrated
21 respirator is shown in Figure 11. Here the flexible cowl
22 5 is formed by vacuum forming and fabricating a hood from
23 a material that will stretch sufficiently to allow the
24 neck seal 25 to pass over the inner helmet 2. The oxygen
25 mask suspension system 3 and the first visor 6 are then
26 fitted as described above.

27
28 Access to the inner to outer helmet fixing points 13 is
29 achieved by means of apertures 37 provided in the
30 flexible cowl 5. Sealing of the flexible cowl 5 to the
31 inner helmet 2 can be achieved by means of compression
32 seals 38. The compression seals 38, attached to the
33 flexible cowl 5, are compressed against the inner helmet
34 2 when the outer helmet 8 is placed on the user's head by

1 the presence of the outer to inner helmet attachment
2 points 10.

3

4 A yet further alternative embodiment of the integrated
5 respirator is shown in Figure 12. In this particular
6 embodiment the flexible cowl 5 consists of two parts.
7 The first part comprises a head cowl 39 that fits over
8 the inner helmet 2 while the second comprises a
9 detachable lower portion 40 that protects the neck and
10 shoulder area. The two parts are held together by a leak
11 proof joint 41 that is similar to that described in
12 Figure 10. The head cowl 39 can be manufactured to
13 conform to the shape of the inner helmet 2. As the lower
14 portion contains the neck seal 25, this is the only
15 component that is required to stretch over the head
16 during fitting.

17

18 The integrated respirators shown in Figures 11 and 12 may
19 be further adapted, so as to incorporate retractable
20 earphones 42 as presented in Figure 13. Each earphone 15
21 is mounted on the flexible respirator by means of
22 Velcro ®. A leaf spring 43 mounted on the inner surface
23 of the inner helmet 2, biases the earphone 15 in a first
24 between a first position as shown in Figure 13(a). When
25 a user pulls on a draw string 44, attached to the leaf
26 spring 44, the bias force is overcome and the earphone 15
27 is moved to a second, retracted position, as shown in
28 Figure 13(b). On releasing the draw string 44 the bias
29 force of the leaf spring 43 acts to return the earphone
30 15 back to the first position. A compressible foam liner
31 (not shown) may also be located between the leaf spring
32 43 and the inner helmet 2 so as to aid in the positioning
33 of the earphone 15.

34

(1 The retractable earphones 42 provide a means for allowing
2 the earphones 15 to be easily displaced thus aiding the
3 donning and doffing of the integrated respirator. This
4 is particularly advantageous for user's who require the
5 use of spectacles as the retractable earphones 42 allow
6 the integrated respirator to be employed without
7 dislodging the spectacles from the user.

8
9 The integrated respirator described in aspects of the
10 present invention exhibits several key advantages over
11 those described in the Prior Art.

12
13 When deployed by a user the integrated respirator
14 provides a significantly high level of comfort and user
15 acceptability since it is designed to avoid direct
16 contact with the user's head. The integrated respirators
17 thereby provide space for head cooling while
18 simultaneously help to eliminate the feeling of
19 claustrophobia and stress that are known to result from
20 respirator hoods that fit closely over the wearer's head.
21 Further embodiments of the present invention incorporate
22 an adjustable visor and retractable earphones both being
23 features that aid in the donning and doffing of the
24 respirator.

25
26 The integrated respirator designs describe above
27 incorporate a certain degree of inherent flexibility.
28 This flexibility allows the integrated respirators to be
29 adjusted so as to improve user comfort while also
30 permitting the same design to be employed by different
31 users. In addition the present design reduces any
32 alignment problems experienced by designs discussed in
33 the Prior Art.

(1 A further advantage of the integrated respirators
2 described herein is that they can be simply manufactured.
3 This manufacturing process is flexible and so enables the
4 use of the most appropriate materials for NBC protection,
5 user acceptability and ease of manufacture.

6

7 The foregoing description of the invention has been
8 presented for purposes of illustration and description
9 and is not intended to be exhaustive or to limit the
10 invention to the precise form disclosed. The described
11 embodiments were chosen and described in order to best
12 explain the principles of the invention and its practical
13 application to thereby enable others skilled in the art
14 to best utilise the invention in various embodiments and
15 with various modifications as are suited to the
16 particular use contemplated. Therefore, further
17 modifications or improvements may be incorporated without
18 departing from the scope of the invention herein
19 intended.

INFORMAL

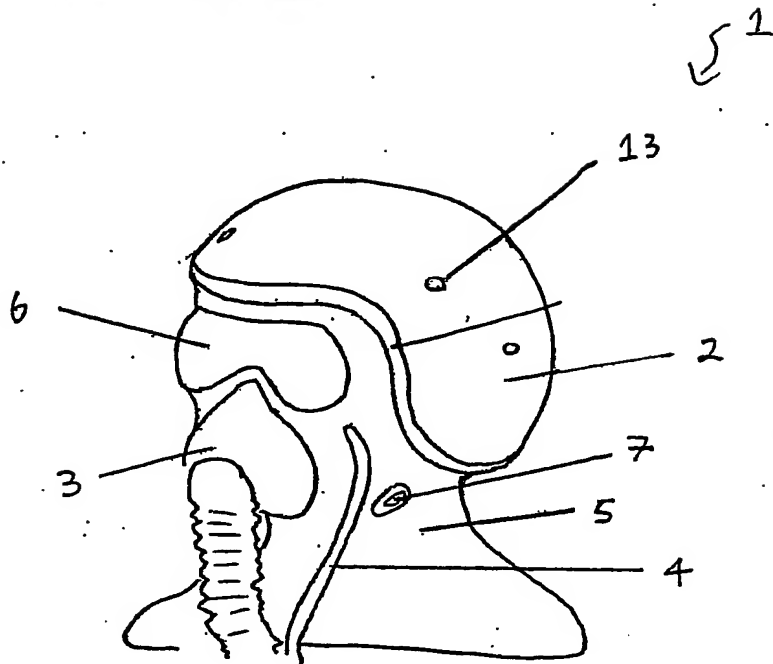


FIGURE 1.

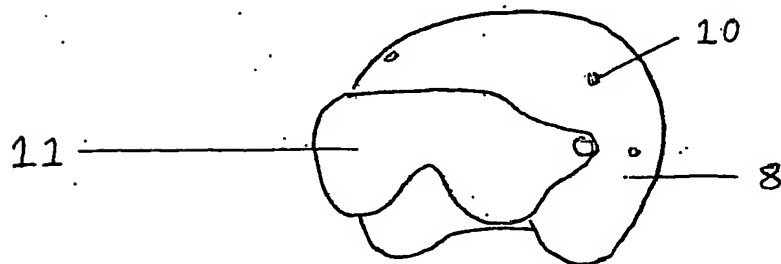


FIGURE 2

INFORMAL

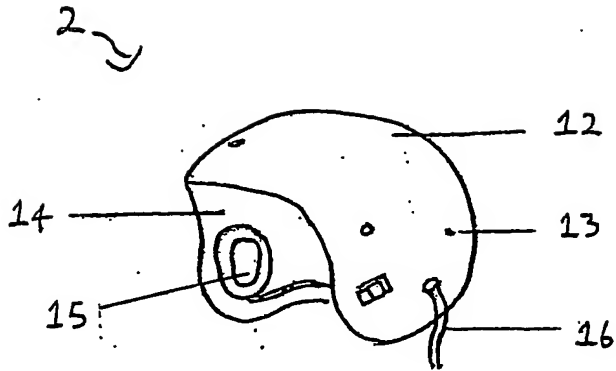


FIGURE 3

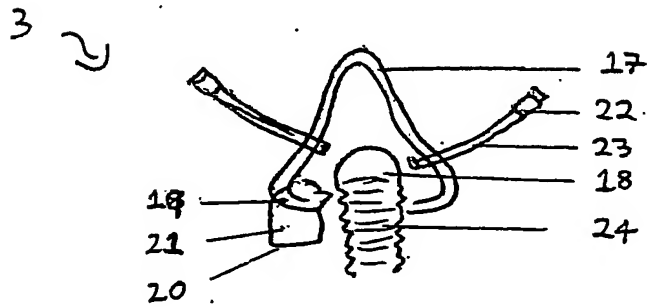


FIGURE 4

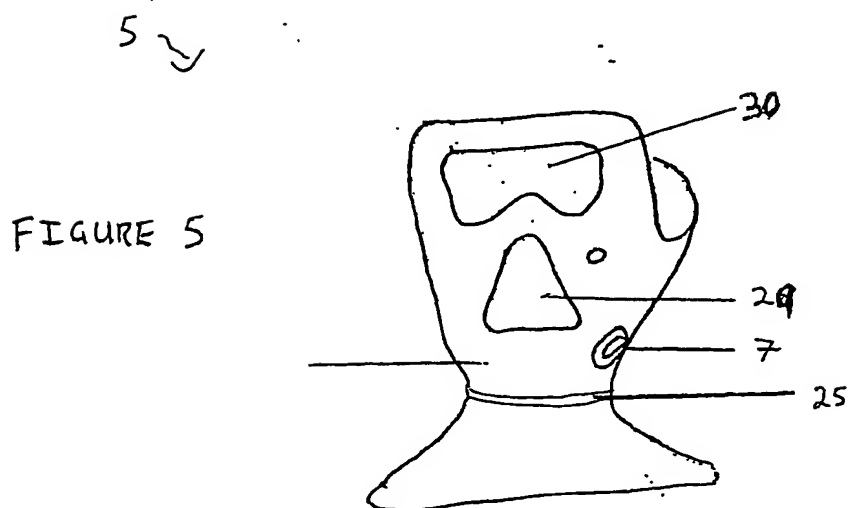


FIGURE 5

INFORMAL

FIGURE 6 (a)

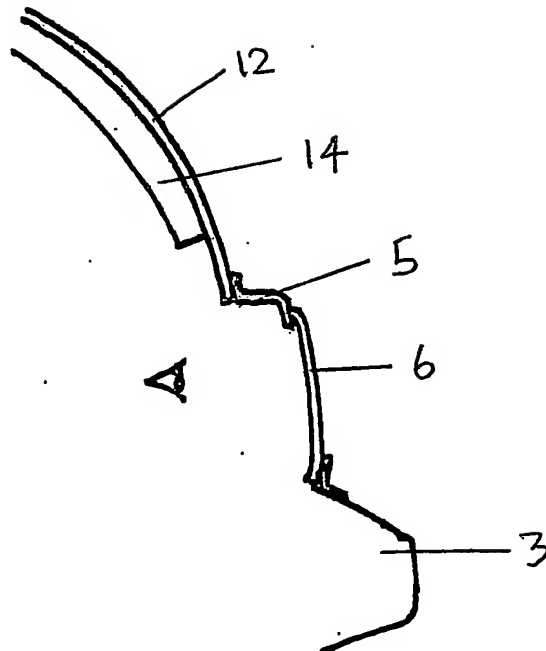
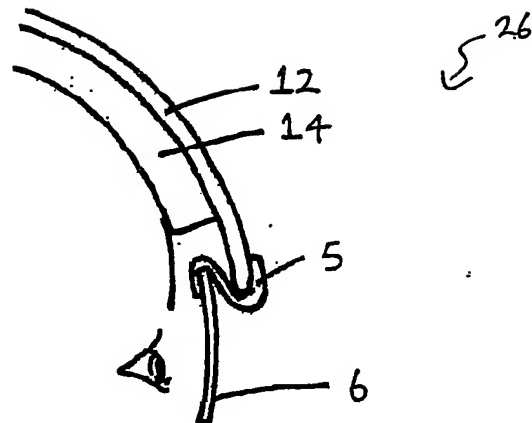
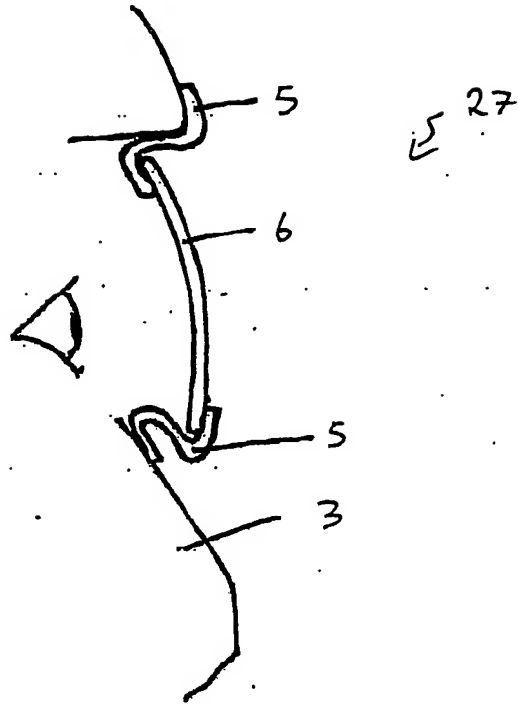


FIGURE 6 (b)

419

INFORMAL

FIGURE 7



5/9

INFORMAL

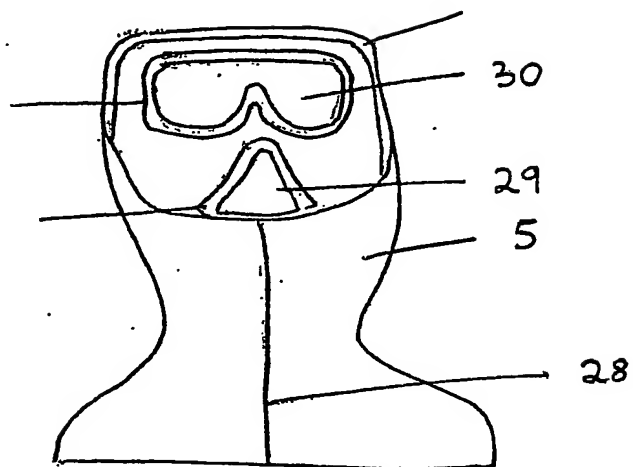


FIGURE 8

619

INFORMAL

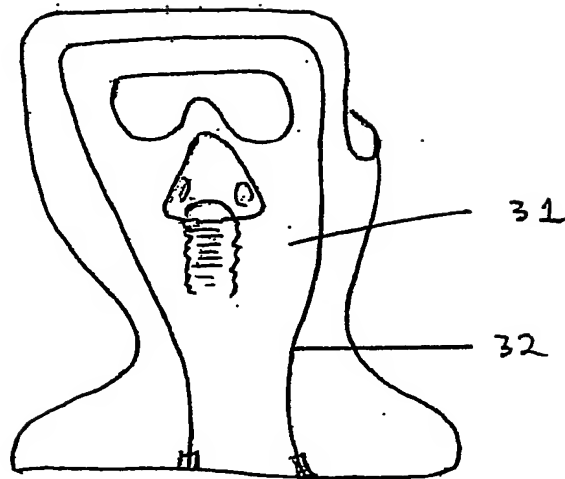


FIGURE 9

719

INFORMAL

32

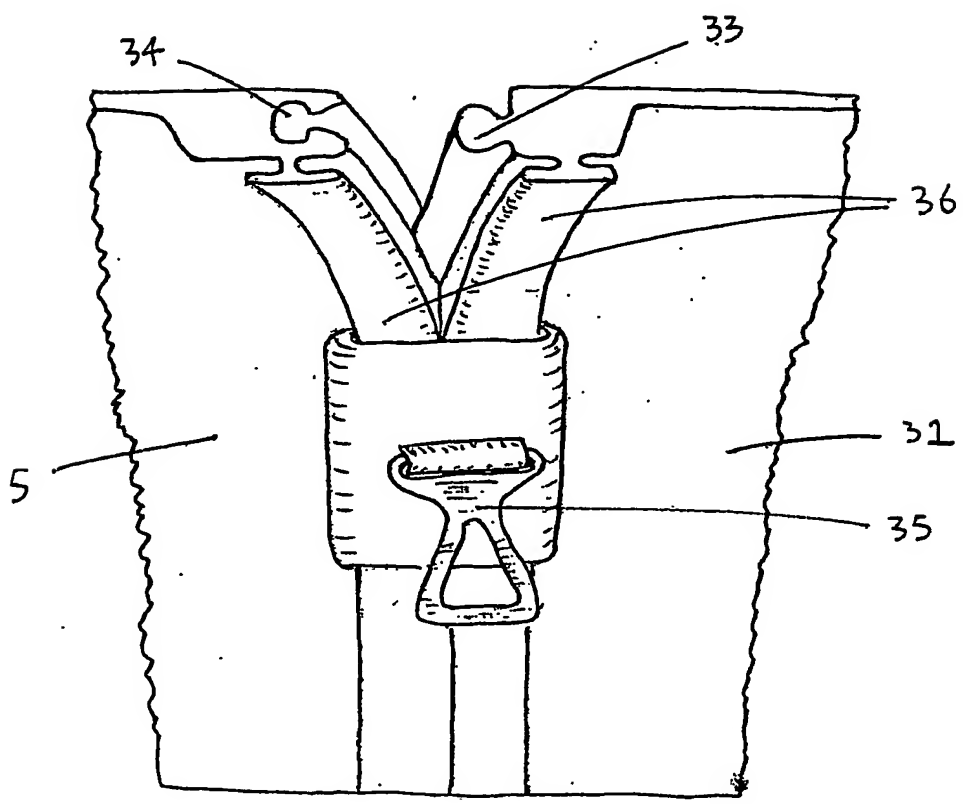


FIGURE 10

8/9

INFORMAL

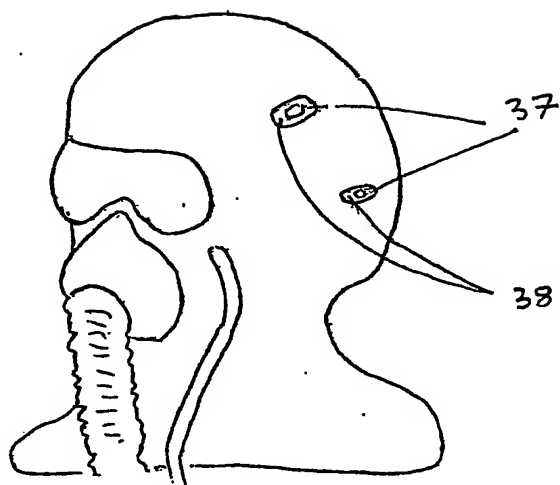


FIGURE 11

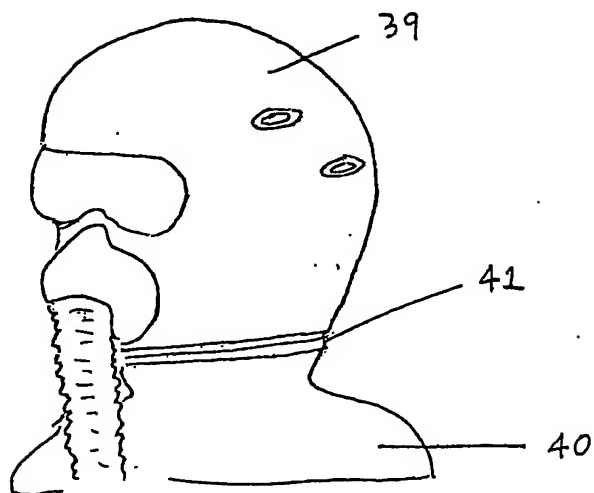
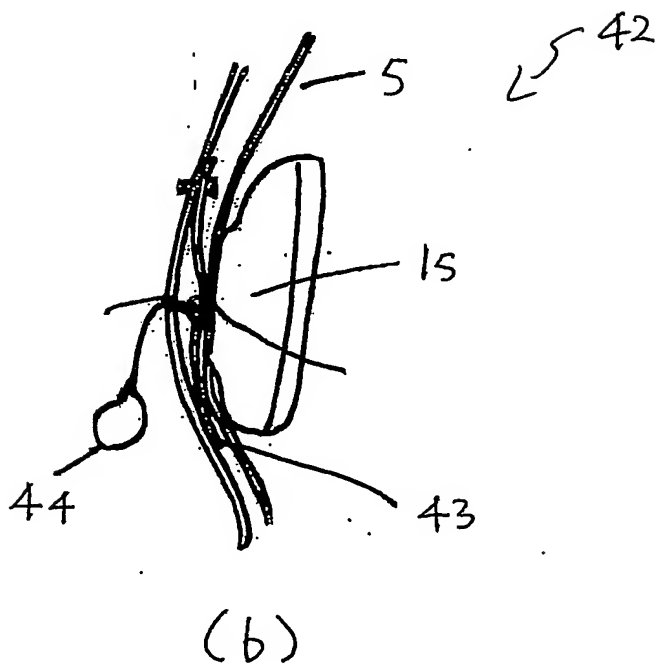
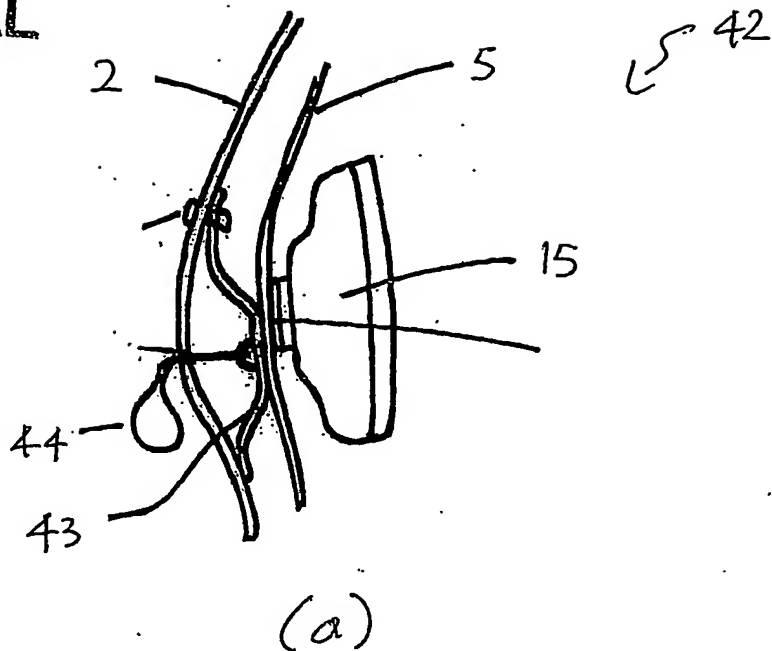


FIGURE 12

9/9

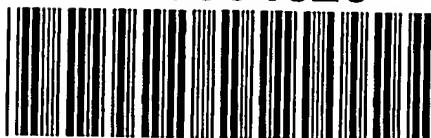
INFORMAL

FIGURE 13



PCT Application

GB0304520



**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☐ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.